NABIH YOUSSEF ASSOCIATES
STRUCTURAL ENGINEERS

March 12, 2025

Monica Suua, Chief Financial Officer
Beach Cities Health District
1200 Del Amo Street
Redondo Beach, CA 90277

RE: **510 North Prospect Avenue**
FRP Strengthening Feasibility (24112.02)

Dear Monica:

Nabih Youssef Associates (NYA) have completed the feasibility study for strengthening the 3-story medical office building located at 510 North Prospect Avenue in Redondo Beach with FRP for "limited" collapse prevention performance at the BSE-1E seismic hazard level (225-year return period). NYA previously evaluated the building in July 2025 and provided conceptual seismic strengthening approaches with reduced scope – excluding foundation work and strengthening of existing walls – focused on reducing risk of the pre-cast concrete portion of the building.

NYA was requested to explore the feasibility of using FRP only to achieve "limited" collapse prevention performance (excluding foundations and walls) at the BSE-1E seismic hazard level. This letter summarizes the findings and recommendations of this effort.

Building Description

The building was originally constructed in 1976 and a north wing was added in 1979. The original building and addition are 3-stories tall and are seismically separated by a 2-inch wide joint. The original building and addition were designed to the 1973 edition of the Uniform Building Code (UBC).

The roof and floors of the original building are constructed of pre-stressed Spancrete planks with concrete topping slabs that span to pre-cast concrete beams and reinforced CMU walls. The beams are supported by pre-cast concrete columns that are continuous to the foundation. The foundation system consists of shallow spread footings. The reinforced CMU walls resist seismic forces.

The 1979 Addition is constructed of a wood framed plywood roof and metal deck with concrete fill floors supported by wide flange steel beams and reinforced CMU walls. The steel beams are supported by wide flange steel columns that are continuous to the foundation. The foundation consists of shallow spread footings and grade beams. The lateral system consists of CMU shear walls.

Building Code Assessment

The City of Redondo Beach does not currently have a mandatory seismic retrofit ordinance for buildings with reinforced masonry walls with stiff/rigid diaphragm. Thus, mandatory seismic upgrade would only be triggered for change of use or occupancy, or significant structural alteration/addition. Retrofit to mitigate identified deficiencies and reduce seismic risk would be considered elective.

Identified Structural Deficiencies

The use of pre-stressed hollow core concrete planks (Spancrete) with concrete topping slab to construct roof and floors of buildings was popular in the 1960's and 1970's. The concrete planks acted as forms for the reinforced concrete topping slab saving time during construction. However, these planks do not participate in resisting seismic forces and the concrete topping slab acts as a structural diaphragm to distribute seismic forces to the vertical elements of the lateral force resisting system, e.g. walls and frames.

The reinforced concrete topping slabs for the 510 Prospect building are 3-inch thick resulting in limited strength capacity. The topping slab contains four to six #4 collector bars along most lines of shear walls, but only two of these bars are developed into the shear wall. The topping slab to CMU wall connection typically consists of #4 bent dowels spaced at 24", with additional dowels at some wall locations. The connection does not develop the full shear strength of the reinforced topping slab. The diaphragms are unable to deliver the expected magnitude of seismic forces to the CMU walls due to the deficient topping slab to wall connections and deficient collector elements.

Conceptual Strengthening

Two conceptual strengthening approaches were previously developed focused on mitigating the diaphragm/collector and topping slab to wall connection deficiencies. Alternate 1 used steel elements connected to the precast planks, topping slab and CMU walls to achieve "limited" collapse prevention performance at the BSE-1E seismic hazard level. Alternate 2 used FRP sheets and anchors to mitigate the topping slab to wall connection deficiency.

The current study focused on extending the approach of Alternate 2 using the latest FRP research and products to address the diaphragm/collector deficiency. NYA met with Fyfe, a FRP manufacturer, to discuss their Duktil FRP Anchoring System as a potential collector. The system works well for tension forces, but not compression forces. The existing pre-cast concrete hollow core planks can resist compression forces. Up to a six foot wide area of the planks is required for a collector since the topping slab and planks are unconfined. This results in a considerable offset of the collector force at the wall resulting in a large eccentricity at the slab-to-wall connection. Per Fyfe, there is insufficient data to use FRP to confine the topping slab and planks. In addition, the force load path (transfer of forces between planks, planks and topping slab, and plank to wall connection) is not well defined.

Based on the above, it is our professional opinion that a FRP only strengthening scheme cannot achieve "limited" collapse prevention performance at the BSE-1E seismic hazard level for the pre-cast concrete portion of the building. Alternate 1 is still the recommended strengthening approach.

Sincerely,

NABIH YOUSSEF & ASSOCIATES "NYA"

Owen Hata
Principal

Cc: J. Reser, S. Stewart